

**A REVIEW OF THE *POLYRHACHIS ACULEATA* SPECIES-GROUP
OF THE SUBGENUS *MYRMA* BILLBERG (HYMENOPTERA:
FORMICIDAE: FORMICINAE), WITH KEYS AND DESCRIPTIONS
OF NEW SPECIES**

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Abstract

The *Polyrhachis aculeata* species-group of the subgenus *Myrma* Billberg is reviewed. Seventeen species of the group are recognised, including nine previously described: *Polyrhachis aculeata* Mayr, *P. cybele* Wheeler, *P. diana* Wheeler, *P. gibbosa* Forel, *P. hemiopticoides* Mukerjee, *P. latona* Wheeler, *P. murina* Emery, *P. numeria* Fr. Smith and *P. pubescens* Mayr. Two former subspecies, *Polyrhachis murina selecta* Forel and *P. pubescens alatisquamis* Forel, are raised to specific status and six species are described as new: *Polyrhachis dimoculata*, *P. kebunraya*, *P. noonananti*, *P. palawanensis*, *P. starri* and *P. watanasiti*. *Polyrhachis alatisquamis* is redescribed and the previously unknown queens of *P. cybele*, *P. latona* and *P. pubescens* are described. A neotype of *Polyrhachis pubescens* Mayr and a lectotype of *P. murina* Emery are designated. A key to the species of the group is included. All species are illustrated and their known distributions summarised.

Introduction

The subgenus *Myrma* Billberg is the most widespread of all the *Polyrhachis* subgenera, occurring throughout the Indo-Malayan, Oriental, Australasian and Ethiopian regions. It is also the second most speciose subgenus, comprising more than one hundred described species and subspecific forms. In an attempt to partition the substantial diversity in such a large subgenus, Emery (1925) established five species-groups, two Afrotropical: *laboriosa* and *viscosa-decemdentata*; two South East Asian: *abrupta* and *zopyrus*; and one occurring in both regions: *militaris-relucens*. Chapman (1963) described a new monotypic subgenus, *Anoplomyrma*, to house his *P. parabiotica* from the Philippines; however, Hung (1967) considered this subgenus to be closely related to *Myrma*. Dorow (1995) concurred with Hung's opinion and listed *Anoplomyrma* as a junior synonym of *Myrma*. Kohout (2006) established the *P. parabiotica* species-group, essentially equivalent to Chapman's *Anoplomyrma*, again placing it within the subgenus *Myrma*.

In his revision of the Afrotropical species, Bolton (1973) recognised six species groups: *alexisi*, *gamaii*, *militaris*, *monista*, *revolii* and *viscosa*, all restricted to the Ethiopian region. A year later (Bolton 1974), he introduced the *inermis* species-group for several South East Asian species, including some placed by Emery (1925) in the very similar *zopyra*-group. Kohout (1989) included all four Australian species of *Myrma* in the *relucens* species-group. Dorow (1995) listed all of Bolton's Afrotropical species-groups; however, he did not attempt to subdivide the Australasian fauna and only mentioned the previously established *abrupta*, *zopyra* and *relucens* species-groups (Emery 1925) in his introduction to the subgenus.

Kohout (1998), dealing with the South East Asian and Australasian fauna of *Myrma*, included four species-groups, the pre-existing *relucens* and *inermis* groups and the new *continua* and *aculeata* groups, although he did not provide diagnoses for either. The *continua* group comprised several closely allied Melanesian species while the *aculeata*-group included a single species.

Ten years later, Kohout (2008) proposed a new *vestita*-group for several closely allied species endemic to Sulawesi and provided diagnoses for the *continua*, *inermis* and *zopyra* species-groups. Here, I diagnose the *aculeata*-group and outline the combination of characters clearly separating it from the other members of the subgenus *Myrma*. Besides six species described here as new, I consider the *aculeata*-group to contain *P. diana* Wheeler, *P. latona* Wheeler and *P. numeria* Fr. Smith, placed by Emery (1925) into the combined *militaris-relucens* species-group, and *P. aculeata* Mayr, *P. cybele* Wheeler, *P. gibbosa* Forel, *P. alatisquamis* Forel, *P. murina* Emery, *P. pubescens* Mayr and *P. selecta* Forel, listed by him in the *abrupta*-group, plus *P. hemiopticoides* Mukerjee, described since Emery's work was published.

Currently, the Afrotropical fauna of *Myrma* remains divided into six species-groups, all restricted to the region, as proposed by Bolton (1973), while the number of species-groups for the Oriental and Australasian fauna has increased to nine. Following the transfer of most of its members to the *aculeata*-group, the *abrupta*-group now comprises only a single, name-bearing species, *P. abrupta* Mayr from Halmahera. The *parabiotica*-group introduced by Kohout (2006) and the *cyaniventris*-group established by Sorger and Zettel (2009) each include three species, all apparently endemic to the Philippines, while the *vestita*-group is restricted to the Indonesian island of Sulawesi. The recently revised *continua*-group (Kohout 2013) comprises mostly Melanesian elements. The *inermis* and *zopyra* species-groups almost equally share the species originally included by Emery (1925) in a single *zopyra*-group, and both are distributed from Sri Lanka and India across Indonesia and the Philippines. Finally, the *relucens*-group, the largest and most widespread of the Oriental and Australasian species-groups, comprises a diverse assemblage of species that could conceivably be subdivided into several more morphologically uniform species-groups.

Methods

Publication dates and spelling of species epithets and authors' names follow Bolton *et al.* (2007). This study is principally based on the worker caste but diagnoses and notes are provided for queens of several species.

Images of specimens were taken with a digital camera attached to a stereomicroscope and processed using Auto-Montage (Syncroscopy, Division of Synoptics Ltd, USA) and Adobe CS2 (Adobe Systems Inc, USA) software. Unless otherwise indicated, all images of the new species depict their primary types. Those of previously described species depict types or

type-compared voucher specimens. Most photographs were taken by Dr Steve O. Shattuck (ANIC), Assoc. Prof. Dr Yoshiaki Hashimoto (MNHA) and Hans Peter Katzmann (UUUG). Photographs of *P. numeria* were taken by the *AntWeb.org* team and are reproduced here by the courtesy of Dr Brian L. Fisher (CASC).

Measurements and indices follow those of Kohout (2008): TL = Total length (the necessarily composite measurement of the outstretched length of the entire ant measured in profile); HL = Head length (the maximum measurable length of the head in perfect full face view measured from the anterior-most point of the clypeal border or teeth, to the posterior-most point of the occipital margin); HW = Head width (width of the head in perfect full face view, measured immediately in front of the eyes); CI = Cephalic index ($HW \times 100/HL$); SL = Scape length (excluding the condyle); SI = Scape index ($SL \times 100/HW$); PW = Pronotal width (width of the pronotal dorsum measured at the bases of pronotal spines); MTL = Metathoracic tibial length (maximum measurable length of the tibia of the hind leg). All measurements were taken using a Zeiss SR stereomicroscope with an eyepiece graticule calibrated against a stage micrometer. All measurements are expressed in millimetres (mm).

Abbreviations used in specimen data are: c. – circa; Cons. – Conservation; Distr. – District; For. – Forest; NP – National Park; nr – near; Prov. – Province; Pt – Point; Ra. – Range; Rd – Road; Riv. – River; rf. – rainforest; w – worker/s; WS – Wildlife Sanctuary.

Institutions and depositories (with the names of cooperating curators) are: AMNH – American Museum of Natural History, New York, NY, USA (Dr J.M. Carpenter); ANIC – Australian National Insect Collection, CSIRO, Canberra, ACT, Australia (Dr S.O. Shattuck); BMNH – The Natural History Museum, London, UK (S. Ryder); BZMI – The Bogor Zoological Museum, Java, Indonesia (Dr Rosichon Ubaidillah); CASC – California Academy of Sciences, San Francisco, CA, USA (Dr B.L. Fisher); GUGG – Göttingen University, Göttingen, Germany (M.M. Boss); IMCI – Indian Museum, Calcutta, India; IRSN – Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium (Drs P. Grootaert, P. Dessart, J. Constant); ITBC – Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia (Prof. Datin Dr Maryati Mohamed, Dr Bakhtiar E.Y.); IZAS – Institute of Zoology, Ukrainian Academy of Sciences, Kiev, Ukraine (Dr A.G. Radchenko); JCUT – James Cook University, Townsville, Queensland, Australia (Prof. Dr S.K.A. Robson); MCZC – Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA (Dr S.P. Cover); MHNG – Muséum d'Histoire Naturelle, Geneva, Switzerland (Dr B. Merz); MNHA – Museum of Nature and Human Activities, Hyogo, Japan (Assoc. Prof. Dr Yoshiaki Hashimoto); MNHU – Museum für Naturkunde, Humboldt-Universität, Berlin, Germany (Dr F.

Koch); MSNG – Civic Museum of Natural History ‘G. Doria’, Genova, Italy (Dr R. Poggi, F. Penati); NHMW – Naturhistorisches Museum, Wien, Austria (Drs H. Zettel, D. Zimmermann); NMCR – National Museum, Prague–Kunratice, Czech Republic (Dr J. Macek); OUMNH – Hope Entomological Collections, Oxford University Museum of Natural History, Oxford, UK (Drs D.J. Mann, J.E. Hogan); PSUT – Prince of Songkla University, Hat Yai, Songkhla Prov., Thailand (Drs S. Watanasit, Nawee Noon-anant); PUPI – Punjabi University, Patiala, India (Dr H. Bharti); QMBA – Queensland Museum, Brisbane, Qld, Australia (Drs C.J. Burwell, G.B. Monteith); RMNH – Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (Dr Ing. C. van Achterberg); SKYC – Kagoshima University, Kagoshima, Japan (Prof. Dr S. Yamane); SMNS – Staatliches Museum für Naturkunde, Stuttgart, Germany (Dr J. Ketterl); UUUG – University of Ulm, Ulm, Germany (H.P. Katzmann).

Systematics

Genus *Polyrhachis* Fr. Smith, 1857

Polyrhachis Fr. Smith, 1857: 58. Type species: *Formica bihamata* Drury, 1773: 73, pl. 38, figs 7, 8, worker; by original designation.

Subgenus *Myrma* Billberg, 1820

Myrma Billberg, 1820: 104. Type species: *Formica militaris* Fabricius, 1781: 493; by subsequent designation of Wheeler, 1911: 859.

Myrma Billberg; Wheeler, 1911: 859 (as genus and senior synonym of *Polyrhachis* Fr. Smith, 1857).

Myrma Billberg; Wheeler, 1922: 993 (as subgenus of *Polyrhachis* Fr. Smith, 1857).

Polyrhachis aculeata species-group

Characters of the *P. aculeata* species-group

Worker. Relatively small ants (HL <1.90) with characteristics of the genus and subgenus. Head with closely approximated frontal carinae. Most species with peculiar, posteriorly truncate eyes, closely resembling those in species of the subgenus *Hemioptica* Roger; however, eye shape varying within group from posteriorly truncate (as in *P. aculeata* Mayr), to relatively flat and conspicuously posteriorly protracted (as in *P. pubescens* Mayr or *P. palawanensis* sp. nov.), or only mildly truncate (as in *P. latona* Wheeler or *P. numeria* Fr. Smith), or virtually normal (as in *P. murina* Emery). Dorsum of mesosoma laterally marginate, evenly convex in side view, with only weakly indicated border between propodeal dorsum and declivity (as in *P. aculeata*), or with a distinct transverse carina dividing propodeal dorsum from shallowly concave declivity (as in *P. palawanensis* sp. nov.). Pronotal shoulders armed with relatively strong, acute, anterolaterally directed spines that are relatively long (as in *P. aculeata*) or short (as in *P. murina*); propodeum armed with upturned, acute, minute teeth or tubercles. Petiolar node armed with two moderately long (as in *P. aculeata* or *P. selecta* Forel) or relatively short

spines (as in *P. noonananti* sp. nov.); spines situated at dorsolateral angles of petiole and separated by transversely broad, more-or-less convex, dorsal margin, which is mostly entire but may be furnished with an intercalary tooth (as in *P. aculeata* and *P. dimoculata* sp. nov.), or weakly medially notched (as in *P. cybele*). Lateral margin of petiole below base of spine with a relatively short tooth (as in *P. cybele* or *P. pubescens*), or a somewhat lengthened and flattened tooth (as in *P. murina* or *P. starri* sp. nov.), which is entire or dorsally notched.

Queen. Apart from larger size and usual sexual characters, including three ocelli and fully developed mesosoma with wings, very similar to worker.

Male. The male is known for only three species: *P. aculeata* (see Forel, 1893: 28), *P. selecta* (Forel, 1911: 215-216) and *P. pubescens* (Fuminori Ito, private collection and QMBA). Their diagnosis is beyond the purpose and scope of this paper.

Within the group the species tend to polarise into two complexes, centring on either *P. aculeata* or *P. pubescens*. The *Polyrhachis aculeata*-complex includes jet-black species with the whole body smooth and highly polished (except in *P. dimoculata*). Pilosity in this group consists of medium length, erect or semierect hairs, variously distributed over most body surfaces, that range from rather sporadic (as in *P. hemiopticoides* Mukerjee) to relatively abundant (as in *P. gibbosa* Forel). Closely appressed pubescence is virtually lacking in most species, except in *P. gibbosa*, where it is present mostly along the lateral margins of the mesosomal dorsum and sides. The *aculeata*-complex is known from Sri Lanka, India and Thailand eastwards to the Philippines, Borneo and Indonesia, including Sumatra, Java and Sulawesi. The *pubescens*-complex includes species with dorsal body surfaces more-or-less distinctly reticulate-punctate or longitudinally striate, with the sculpture of most species partly or completely obscured by closely appressed, rather abundant, silvery-grey or golden pubescence. Species in this complex have rather short, erect hairs distributed in various densities over most body surfaces. The *pubescens*-complex is known from India, Thailand, Vietnam, China, Taiwan and Japan and southwards to the Philippines, Peninsular Malaysia, Borneo, Sumatra, Java and Sulawesi.

Key to *Polyrhachis aculeata*-group species

(Based on worker caste).

- 1 Dorsal body surfaces smooth, highly polished, mostly glabrous (e.g. Figs 6, 15), only rarely with scattered long hairs or a pile of sparse whitish pubescence in some species (Figs 4, 13) (*aculeata*-complex, in part) 2
- Dorsal body surfaces finely sculptured, reticulate-punctate or longitudinally striate, semi-polished or opaque with sculpture often obscured by abundant, closely appressed, silvery-grey or golden pubescence (e.g. Figs 25, 36) 6

- 2 Pronotal spines long and slender, more than 2x as long as width at their bases; dorsal petiolar spines relatively long (e.g. Figs 4, 5) 3
 - Pronotal spines relatively short, broad-based, only about 1.5x as long as width at their bases; dorsal petiolar spines reduced to short, acute teeth (Figs 17, 18) (Thailand) *P. noonananti* **sp. nov.**
3. Distinct pile of relatively long, appressed, silvery or whitish pubescence rather abundant over most body surfaces, notably along lateral margins of mesosomal dorsum and sides (Figs 10, 13); petiolar spines rather stubby, distinctly dorso-medially flattened (Sri Lanka) *P. gibbosa* Forel
 - Short, appressed, silvery or whitish pubescence very sparse on pronotal collar and sides of mesosoma and petiole, virtually absent from most dorsal body surfaces; petiolar spines slender, only weakly flattened or almost round in cross-section 4
- 4 Body slender with long and slender pronotal and petiolar spines; antennal scapes with numerous, erect or semierect hairs; appendages generally light reddish brown 5
 - Body broader with shorter and thicker pronotal and petiolar spines; antennal scapes without hairs or with only a few hairs along superior edge; appendages distinctly darker, medium to dark reddish brown (Figs 6, 7) (Borneo, Sumatra, Java, Sulawesi, Philippines) *P. cybele* Wheeler
- 5 Relatively long, erect or semierect hairs rather abundant over most body surfaces (Figs 1, 4) (India, Sri Lanka) *P. aculeata* Mayr
 - Relatively long, erect or semierect hairs present on front of head, gastral apex and appendages; hairs virtually absent from vertex of head, dorsum of mesosoma and petiole (Fig. 15) (India, Thailand, Laos)
..... *P. hemiopicoides* Mukerjee
- 6 Head, mesosoma and petiole very finely sculptured, semi-polished; gaster highly polished; pilosity and pubescence virtually absent from all dorsal body surfaces (Figs 3, 8, 9) (*aculeata*-complex, in part) (Borneo)
..... *P. dimoculata* **sp. nov.**
 - Head, mesosoma, petiole and gaster finely or distinctly sculptured, opaque; pilosity and pubescence abundant over most body surfaces, mostly obscuring underlying sculpturation (e.g. Figs 25, 38) (*pubescens*-complex) 7
- 7 Eyes strongly posteriorly truncate or protracted (e.g. Figs 25, 59) 8
 - Eyes normal or only weakly posteriorly truncate (e.g. Figs 44, 51) 12
- 8 Node of petiole strongly transverse, distinctly wider than high (Figs 20, 29) 9
 - Node of petiole about as wide as high (e.g. Figs 22, 35) 10

- 9 Eyes very strongly protracted posteriorly, with somewhat angular outline in full face view (Fig. 27), posterior faces virtually flat, which is notably evident when viewed from behind (Fig. 28) (Philippines) *P. palawanensis* **sp. nov.**
- Eyes posteriorly truncate, with smooth convex outline in full face view (Fig. 19) (India, Myanmar, Thailand) *P. alatisquamis* Forel
- 10 Antennal scapes with numerous short hairs; whole body with abundant, closely appressed pubescence, almost hiding underlying sculpturation (Fig. 25) (India to Borneo) *P. pubescens* Mayr
- Antennal scapes with only occasional hairs present; body pubescence relatively sparse, not completely hiding underlying sculpturation (Figs 59, 61) 11
- 11 Bases of antennal scapes distinctly broadened (Figs 57, 58); eyes only moderately truncate (Figs 57, 58, 61) (Thailand) *P. watanasiti* **sp. nov.**
- Bases of antennal scapes not broadened (Fig. 55); eyes strongly truncate (Figs 55, 59) (Java) *P. kebunraya* **sp. nov.**
- 12 Pronotal spines relatively long, more than 1.5x as long as width at their bases; petiole with dorsolateral spines moderately long, distinctly longer than short and stubby lateral teeth (Figs 35, 50) 13
- Pronotal spines distinctly shorter, only about as long as width at their bases; petiole with dorsolateral spines relatively short, about same length as rather prominent lateral teeth (Figs 41, 43) 16
- 13 Dorsum of petiole with distinct intercalary tooth (Figs 35, 50); body with rather diluted, pale golden, appressed pubescence distributed over most dorsal surfaces 14
- Dorsum of petiole without intercalary tooth (Figs 33, 51); body with rather abundant, silvery grey, appressed pubescence that almost completely hides underlying sculpturation 15
- 14 Eyes distinctly convex (Fig. 53) (Java) *P. selecta* Forel
- Eyes rather flat (Fig. 38) (Japan, China, Vietnam) *P. latona* Wheeler
- 15 Antennal scapes with numerous short hairs along superior edge (Sulawesi, Sunda Strait) *P. numeria* Fr. Smith
- Antennal scapes without hairs (Philippines) *P. diana* Wheeler
- 16 Dorsal margin of petiole strongly raised and bluntly angular medially (Fig. 43); dorsum of mesosoma relatively slender, only moderately convex in lateral view (Figs 46, 47) (Philippines) *P. starri* **sp. nov.**
- Dorsal margin of petiole only weakly raised with distinct intercalary tooth (Fig. 41); dorsum of mesosoma relatively broad, distinctly convex in lateral view (Figs 44, 45) (Borneo, Sumatra) *P. murina* Emery



Figs 1-9. *Polyrhachis aculeata*-group spp: (1-3) head in full face view; (4, 6, 8) dorsal view; (5, 7, 9) lateral view. (1, 4-5) *P. aculeata* Mayr; (2, 6-7) *P. cybele* Wheeler; (3, 8-9) *P. dimoculata* sp. nov. (holotype) (not to scale).

Polyrhachis aculeata-complex
***Polyrhachis aculeata* Mayr, 1879**
 (Figs 1, 4-5)

Polyrhachis aculeata Mayr, 1879: 657. Holotype worker. Type locality: INDIA (as 'Ostindien') (Schmidt-Göbel), NHMW (examined).

Polyrhachis aculeata Mayr; Emery, 1887: 235. Description of queen.

Polyrhachis aculeata Mayr; Forel, 1893: 28. Description of male.

Hemioptica aculeata Mayr; Bingham, 1903: 382. Combination in *Hemioptica* Roger.

Polyrhachis (Hemioptica) aculeata Mayr; Wheeler, 1919: 126. Combination in *P. (Hemioptica)*.

Polyrhachis (Myrma) aculeata Mayr; Emery, 1925: 205. Combination in *P. (Myrma)*.

Polyrhachis (Myrma) aculeata Mayr; Dorow & Kohout, 1995: 94.

Additional material examined. INDIA: Travancore (H. Ferguson) (w); Kerala, Kondotty, 23.viii.1962 (A.B. Soans) (w).

Worker. Dimensions (holotype cited first): TL c. (gaster missing), 6.40-6.80; HL 1.59, 1.59-1.75; HW 1.43, 1.36-1.43; CI 84, 81-84; SL 1.93, 1.93-2.03; SI 144, 142-149; PW 1.30, 1.12-1.30; MTL 2.06, 2.06-2.21 (1+2 measured).

Remarks. I have examined two worker specimens of *P. aculeata* from the Mayr collection in Vienna (NHMW), neither labelled as the type. However, in the original description Mayr noted 'Ich besitze nur ein Exemplar aus Ostindien, welches ich Herrn Professor Schmidt-Göbel verdanke.' I have therefore considered the specimen bearing a tag inscribed 'Ind. or. Schm.' to be the holotype of *P. aculeata* and labelled it accordingly. The specimen bears two additional, original labels as follows: '*P. aculeata* det. G. Mayr' and 'Collect. G. Mayr'. The specimen is pinned and missing the gaster, but otherwise is in relatively sound condition.

***Polyrhachis cybele* Wheeler, 1919**
 (Figs 2, 6-7)

Polyrhachis (Hemioptica) aculeata ssp. *cybele* Wheeler, 1919: 126. Syntype workers. Type locality: BORNEO, SARAWAK, Kuching (J. Hewitt), MCZC (Type 9076) (examined).

Polyrhachis (Myrma) aculeata subsp. *cybele* Wheeler; Emery, 1925: 205. Combination in *P. (Myrma)*.

Polyrhachis cybele Wheeler; Kohout, 2008: 271, fig. 3A-B. Raised to species.

Additional material examined. BORNEO, SABAH: W coast Residency, Ranau, 500m, 22-25.i.1959 (T.C. Maa) (w); Crocker Ra., Mahua Falls, 05°47'N, 116°24'E, c. 950 m, rf., 4.xi.2000 (R.J. Kohout acc. 2000.198) (w, ♀); SARAWAK: Sadong, Kampong Tapuh, 300-450 m, 4-9.vii.1958 (T.C. Maa) (w). BRUNEI: Belait Distr., c. 1-2 km SE of Melilas Longhouse, rf., 16.vii.1994 (R.J. Kohout *et al.* acc.94.121) (w). INDONESIA, SUMATRA: Kepahiang, xi-xii.1925 (H.C. Kellers, Navy Dept. Eclipse Exped.) (w); Pematang, Siantar, vii-viii. (?year) (J. Mathews) (w); JAVA: Bogor, Kebun Raya, 06°35'S, 106°47'E, 290 m, 7-12.ix.1999, S.K.A. Robson #823 (w);

SULAWESI (as Celebes): Kandari, iii.1874 (O. Beccari) (w); SULAWESI TENGAH: Lore-Lindu NP, 01°15'S, 120°20'E, nr Dongi-Dongi, c. 1010m, 4-9.xii.1985 (Malaise trap 2) (C. van Achterberg) (w); SULAWESI SELATAN: Sampulage nr. Mangkrana, 02°20'S, 120°48'E, 800 m, 19.x.1999 (K. Ogata & K. Masaoka) (w). PHILIPPINES, NEGROS I.: Dumaguete (J.W. Chapman) (w); MINDANAO: Davao (A. Reyes) (w).

Worker. Dimensions (syntype cited first): TL c. 7.00, 5.95-7.96; HL 1.68, 1.53-1.87; HW 1.43, 1.28-1.56; CI 85, 75-85; SL 2.09, 1.81-2.28; SI 146, 133-150; PW 1.22, 1.06-1.50; MTL 2.15, 1.96-2.46 (1+25 measured).

Queen (not previously described). Dimensions: TL c. 8.26; HL 1.84; HW 1.59; CI 86; SL 2.18; SI 137; PW 1.72; MTL 2.34 (1 measured).

Queen larger than worker with usual characters identifying full sexuality, including three ocelli, complete thoracic structure and wings. Pronotal spines distinctly shorter, only marginally longer than their basal width, anteriorly directed. Mesoscutum somewhat wider than long; lateral margins converging anteriorly into smoothly rounded anterior margin; median line distinct; parapsides only weakly raised posteriorly; mesoscutum in profile with widely rounded anterior face and almost flat dorsum posteriorly. Mesoscutellum moderately convex, only marginally elevated above dorsal plane of mesosoma. Propodeal dorsum convex in outline with lateral margins terminating in narrowly rounded, medially continuous ridges that form rather thin, transverse, medially bowed line dividing propodeal dorsum from declivity. Petiole biconvex in profile, dorsolateral spines reduced to rather blunt, wide-based teeth, only marginally longer than acute lateral teeth; dorsal margin very shallowly, medially notched. Rather smooth and highly polished dorsal body surfaces, pilosity, pubescence and colour, very similar to worker.

Remarks. *Polyrhachis cybele* is a relatively uncommon species distributed from Borneo, Sumatra and Java to Sulawesi and the Philippines. Specimens from Sumatra are rather similar to those of the Bornean population, but those from Sulawesi and Java differ in a number of characters. Sulawesi specimens are characterised by a distinctly broader pronotal dorsum and shorter antennal scapes (SI 133-140 versus 144-150 in other populations). In contrast, the single available series of specimens from Java (Kebun Raya, Bogor), differ markedly from other populations by their distinctly more slender body (PW 1.06-1.18 versus 1.22-1.50 in specimens from Borneo, Sumatra and Sulawesi). The Bogor specimens also have the body hairs distinctly less abundant and virtually absent from the antennal scapes, vertex of the head, dorsum of the mesosoma and most of the gastral dorsum, except the apex. However, specimens from across the entire distribution are closely similar in their general appearance and I believe all the examined populations are conspecific.

Polyrhachis cybele is a very characteristic species discussed in detail, together with the closely similar *P. aculeata* Mayr, *P. gibbosa* Forel and *P. hemiopticoides* Mukerjee, by Kohout (2008: 258, 271). The distinguishing characters separating *P. cybele* from the closely similar new species *P. dimoculata* are given below in the remarks section of that species.

***Polyrhachis dimoculata* sp. nov.**

(Figs 3, 8-9)

Types. *Holotype* worker, BORNEO, SABAH: Danum Valley Cons. Area, Segama River Trail, 04°57'N, 117°48'E, 11.xi.2000, rf., R.J. Kohout acc.2000.222 (worker). *Paratype* worker, SABAH: Poring Hot Springs, iv.1993, A. Floren (*Polyrhachis* #14) (worker). Type deposition: Holotype in ITBC, paratype in QMBA.

Description. Worker. Dimensions (holotype cited first): TL c. 7.66, 7.41; HL 1.90, 1.84; HW 1.53, 1.43; CI 80, 78; SL 2.43, 2.37; SI 159, 166; PW 1.37, 1.34; MTL 2.62, 2.50 (2 measured).

Mandibles with 5 teeth. Anterior clypeal margin arcuate, narrowly medially truncate. Clypeus with blunt median carina, virtually straight in profile, posteriorly rounding into weakly impressed basal margin. Frontal triangle distinct. Frontal carinae sinuate with rather strongly raised margins; central area narrow with distinct median furrow. Sides of head in front of eyes converging towards mandibular bases in evenly convex line; behind eyes sides converging into smoothly rounded occipital corners. Eyes convex, strongly posteriorly truncate, in full face view clearly breaking lateral cephalic outline. Ocelli lacking; positions of lateral ocelli indicated by weakly raised cephalic sculpturation. Dorsum of mesosoma evenly convex in profile; pronotal humeri armed with rather long, acute spines; dorsum of each spine with distinct, rather acute, longitudinal carina running from base towards and almost reaching tip; outer edges of spines acute, weakly notched basally and continuous with lateral margins of pronotal dorsum. Promesonotal suture distinctly impressed. Mesonotal dorsum with lateral margins narrowly rounded and weakly raised anteriorly; metanotal groove impressed laterally, rather flat medially. Propodeal dorsum with lateral margins distinctly converging posteriorly and terminating in narrowly rounded, weakly raised ridges that are continued medially and merge into a dorsally bowed, somewhat medially notched carina dividing propodeal dorsum from shallowly concave declivity; secondary carinae extending from propodeal margins towards propodeal spiracles dividing declivity from sides of propodeum. Petiole biconvex in profile, armed with a pair of dorsolaterally and posteriorly directed, acute spines, situated on dorsolateral angles close to posterior face of petiole; dorsal margin of petiole with intercalary tooth visible in lateral view; distinctly shorter, rather blunt tooth situated laterally below base of each spine. Anterior face of first gastral segment concave to accommodate posterior face of petiole, anterodorsal margin distinctly lower than full height of petiolar node.

Mandibles finely, longitudinally striate with numerous piliferous pits. Body surfaces very finely sculptured, reticulate-punctate, rather semi-polished to opaque, sculpture on pronotal dorsum, notably along lateral margins, somewhat longitudinally directed; bases of pronotal spines more distinctly longitudinally striate. Propodeal declivity, tips of pronotal and petiolar spines and gaster, smooth and polished.

Mandibles along masticatory borders with a few semierect, relatively short, golden hairs. Anterior clypeal margin with a few moderately long, anteriorly directed, golden setae medially. A few pairs of moderately long, erect, golden hairs along basal margin of clypeus and along frontal carinae. Hairs totally absent from vertex of head, antennal scapes, dorsum of mesosoma, petiole and dorsum of gaster. Only a few,

moderately long hairs on anterior and posterior faces of fore coxae. Gaster with numerous, posteriorly directed hairs around apex and on venter.

Colour. Black throughout, with only extreme tip of apical funicular segment reddish brown.

Sexuals and immature stages unknown.

Etymology. Derived from the combination of the Latin words *dimidiatus*, meaning halved, and *oculus*, meaning eye, in reference to the rather peculiar truncate eyes.

Remarks. *Polyrhachis dimoculata* is similar to other species of the *aculeata*-complex; however, it is easily recognised by its very fine body sculpturation that produces a very characteristic, somewhat semi-polished appearance to the head, mesosoma and petiole (Figs 3, 8-9), which contrasts with the highly polished gaster. Also, unlike other species of the complex, *P. dimoculata* has virtually no pubescence and pilosity on all the dorsal body surfaces.

Polyrhachis dimoculata appears to be a rather rare species and, in spite of extensive collecting undertaken in recent years at Danum Valley and Kinabalu Park, the holotype and paratype remain the only specimens known. The holotype was collected foraging on low vegetation along the Segama River walking track and the paratype by fogging the rainforest canopy at Poring Hot Springs.

***Polyrhachis gibbosa* Forel, 1908**

(Figs 10, 13-14)

Polyrhachis aculeata var. *gibbosa* Forel, 1908: 9. Syntype workers. Type locality: SRI LANKA (as 'Ceylan'), Puwakpitiya, 1906-7 (E. Bugnion), MHNG (examined).

Polyrhachis aculeata var. *gibbosa* Forel; Forel, 1913: 139 (footnote). Description of queen.

Polyrhachis (Myrma) aculeata var. *gibbosa* Forel; Emery, 1925: 205. Combination in *P. (Myrma)*.

Polyrhachis gibbosa Forel; Kohout, 2008: 258. Raised to species.

Additional material examined. SRI LANKA: Sinharaja For. Reserve, 06°20'-06°26'N, 80°23'-80°33'E, 173-657 m, 2006-2007 (Nihara R. Gunawardene) (w).

Worker. Dimensions (syntypes): TL c. 5.85-6.35; HL 1.59-1.62; HW 1.31-1.37; CI 82-84; SL 1.87-1.93; SI 141-143; PW 1.18-1.25; MTL 1.87-1.96 (2 measured).

Remarks. *Polyrhachis gibbosa* differs from the other species of the *aculeata*-complex by the dorsal body surfaces being only partly polished and the mesonotum and propodeum being more distinctly sculptured. The mesosoma also appears somewhat shorter and relatively broad, with the pronotal spines only about as long as the width at their bases and the mesosomal dorsum is



Figs 10-18. *Polyrhachis aculeata*-group spp: (10-12) head in full face view; (13, 15, 17) dorsal view; (14, 16, 18) lateral view. (10, 13-14) *P. gibbosa* Forel; (11, 15-16) *P. hemiopticoides* Mukerjee; (12, 17-18) *P. noonananti* sp. nov. (holotype) (not to scale).

highly convex in lateral view. The body is entirely black with rather abundant, silvery, appressed pubescence, notably on the pronotal collar and along the dorsolateral margins and sides of the mesosoma.

***Polyrhachis hemiopticoides* Mukerjee, 1930**

(Figs 11, 15-16)

Polyrhachis (Myrma) hemiopticoides Mukerjee, 1930: 161, fig. 5. Syntype workers.

Type locality: INDIA, Calcutta (C.A. Paiva), IMCI.

Additional material examined. INDIA: Ayur, North Salem, F.R.I. Sandal Insect Survey, 11.ix.30, Plot 21 (w). LAOS: Borikhane Prov., Pak Kading, 100 m, 22.iv.1965, in bamboo (J.L. Gressitt) (w). SOUTHERN THAILAND: Surat Thani Prov., Klong Sang W'life Sanctuary, Chiew Larn reservoir, iii-v.1994, lowland rf., fogging (L. Lebel) (w).

Worker. Dimensions: TL c. 6.55-7.31; HL 1.68-1.81; HW 1.40-1.56; CI 83-86; SL 2.03-2.06; SI 132-145; PW 1.18-1.28; MTL 2.12-2.21 (3 measured).

Sexuals and immature stages unknown.

Remarks. I did not have the opportunity to examine the syntypes of *P. hemiopticoides* lodged in the Indian Museum in Calcutta. In lieu of the original types, I have examined, by the courtesy of Dr Himender Bharti of Punjabi University, Patiala, India (PUI), a specimen from Ayur identified by the original author (see Mukerjee 1934: 11-12), with the collection data listed above.

Polyrhachis hemiopticoides is a rather elegant species closely resembling both *P. aculeata* and *P. cybele*. It shares with the former a slender body with rather long and slender pronotal and petiolar spines and markedly light, reddish brown appendages. In contrast, *P. cybele* is more robust with thicker and shorter pronotal and petiolar spines and has generally very dark appendages. The petiole in *P. hemiopticoides* and *P. cybele* is broadly transverse, with a distinctly arcuate dorsal edge and dorsolateral spines arising obliquely from close to the posterior face of the petiole. As a result, the dorsal edge of the petiole is clearly visible in lateral view (Fig. 7). In comparison, the dorsal edge of the petiole in *P. aculeata* is less prominent and, in lateral view, is hidden by the more upright dorsolateral spines (Fig. 5). *Polyrhachis aculeata* also differs by the presence of numerous, relatively long, erect or semierect hairs that, in both the other species, are distinctly less abundant and virtually confined to the head and gaster (see also Kohout 2008: 258, 271).

***Polyrhachis noonananti* sp. nov.**

(Figs 12, 17-18)

Type. Holotype worker, SOUTHERN THAILAND: Surat Thani Prov., Klong Sang WS, Chiew Larn reservoir, iii-v.1994, lowland rf., fogging, L. Lebel (worker). Type distribution: Holotype worker in QMBA (QMT 183498).

Description. Worker. Dimensions (holotype): TL c. 5.74; HL 1.43; HW 1.22; CI 85; SL 1.87; SI 153; PW 0.97; MTL 1.93.

Anterior clypeal margin arcuate, widely medially truncate. Clypeus with median carina blunt anteriorly, weakly raised towards almost flat basal margin; straight in profile. Frontal triangle distinct; short median carina running for short distance from triangle towards central area. Frontal carinae closely approximate and rather flat anteriorly, distinctly raised and sinuate from midlength with central area relatively wide posteriorly. Sides of head in front of eyes converging towards mandibular bases in weakly convex line; behind eyes sides widely rounding into occipital margin. Eyes convex, only moderately posteriorly truncate. Ocelli lacking. Dorsum of mesosoma convex longitudinally and transversely, with rather poorly developed lateral margins and in profile with a very shallow depression indicating position of metanotal groove. Pronotal spines relatively short, about 1.5x longer than their basal width; lateral margins of pronotal dorsum subparallel, gently rounding into weakly impressed promesonotal suture. Mesonotal dorsum with lateral margins flat, weakly converging posteriorly; metanotal groove only weakly impressed dorsally. Propodeal dorsum with lateral margins converging posteriorly and terminating in narrowly rounded, weakly raised ridges that continue medially and merge into a dorsally bowed carina dividing propodeal dorsum from shallowly concave declivity; secondary carinae extending from propodeal margins towards propodeal spiracles, dividing declivity from sides of propodeum. Petiole biconvex in profile, armed with a pair of very short, acute spines situated on dorsolateral angles of petiole; rather blunt, secondary tooth situated laterally at base of each spine. Anterior face of first gastral segment in unique holotype is damaged beyond recognition of its shape or height (Figs 17, 18).

Mandibles finely, longitudinally striate with numerous piliferous pits. All dorsal body surfaces very smooth and highly polished. Sides of mesosoma very finely wrinkled.

Mandibles along masticatory borders and near bases with a few semierect, relatively short, golden hairs. Anterior clypeal margin with a few moderately long, anteriorly directed, golden setae medially. A few pairs of moderately long, erect, golden hairs on clypeus and along frontal carinae. Hairs totally absent from dorsum of mesosoma, petiole, dorsum of first gastral segment, femora and tibiae. Only a few short hairs along superior edge of antennal scapes; longer hairs on anterior and posterior faces of fore coxae. Gaster with numerous, posteriorly directed hairs around apex and on gastral venter.

Colour. Body black; mandibular teeth, antennae, tarsi and venter of gaster very dark reddish brown. Trochanters, femora and tibiae, except joints, distinctly light reddish brown.

Sexuals and immature stages unknown.

Etymology. Named after Dr Nawee Noon-anant of Prince of Songkla University, Hat Yai, Thailand, in appreciation of his support during my visit to southern Thailand and for making the *Polyrhachis* material in his collection available for examination.

Remarks. *Polyrhachis noonannanti* is very similar to other species of the *aculeata*-complex (e.g. *P. cybele* and *P. hemiopticoides*); however, it is easily

separable by the unique structure of the front of the head (*i.e.* a short median carina running from the frontal triangle to the central area between the anteriorly flat frontal carinae), the presence of a shallow posterior depression in the profile of the mesosoma and the greatly reduced petiolar spines.

Polyrhachis pubescens-complex

***Polyrhachis alatisquamis* Forel, 1893, stat. nov.**

(Figs 19-20, 23-24)

Polyrhachis pubescens var. *alatisquamis* Forel, 1893: 17 (diagnosis in key), 28.

Holotype worker. Type locality: MYANMAR (as Birmanie), Ataran Valley, iii.1891 (C.T. Bingham), MHNG (examined).

Polyrhachis (Myrma) pubescens var. *alatisquamis* Forel; Emery, 1925: 205. Combination in *P. (Myrma)*.

Additional material examined. THAILAND (as Siam): (no further data) (w). INDIA, ANDAMAN IS: 30.v.1905 (G. Rogers, BMNH 1006-204) (w).

Forel (1893: 17) only gave a very short diagnosis of *P. pubescens* var. *alatisquamis* by providing characters distinguishing it from *P. pubescens* in a key, mainly alluding to the form of the petiole. Consequently, I present a full redescription of the species below.

Redescription. Worker. Dimensions (holotype cited first): TL c. 5.85, 5.49-6.00; HL 1.43, 1.43-1.50; HW 1.12, 1.06-1.18; CI 78, 74-79; SL 1.84, 1.72-1.96; SI 164, 162-166; PW 1.00, 0.97-1.06; MTL 1.78, 1.72-1.84 (1+2 measured).

Mandible with 5 teeth slightly reducing in length towards mandibular base. Anterior clypeal margin arcuate, narrowly medially truncate. Clypeus with distinct median carina; virtually straight in profile with moderately impressed basal margin. Frontal triangle poorly indicated. Frontal carinae sinuate with margins moderately raised; central area with distinct frontal furrow. Sides of head in front of eyes weakly convex towards mandibular bases; behind eyes sides rounding into relatively narrow occipital margin. Eyes convex, distinctly protracted posteriorly; clearly exceeding lateral cephalic outline in full face view. Ocelli lacking. Dorsum of mesosoma evenly convex in profile; pronotal dorsum armed with very slender and acute spines, about 3x as long as their basal width; spines anterolaterally directed and curving slightly downwards; lateral edges of spines acute and continuous with subparallel margins of pronotum. Promesonotal suture distinctly impressed laterally, virtually flat medially; mesonotal dorsum strongly transverse, about 2.5x as wide as long with lateral margins narrowly rounded and raised anteriorly, widely rounded posteriorly into medially indistinct metanotal groove. Propodeal dorsum with lateral margins converging posteriorly and terminating in distinct, dorsally raised ridges; inner borders of ridges continued medially and merging into transverse carina dividing dorsum from weakly concave declivity; secondary carinae extending from propodeal margins towards propodeal spiracles, dividing declivity from sides of propodeum. Petiole biconvex in profile; dorsum strongly transverse with weakly convex dorsal margin armed with pair of dorsolaterally and posteriorly directed spines situated on dorsolateral angles of

petiole; shorter, rather flat, secondary spine situated laterally at base of each spine. Anterior face of first gastral segment concave to accommodate posterior face of petiole; anterior margin rather narrowly rounding onto dorsum.

Mandibles distinctly, longitudinally striate, semipolished. Clypeus reticulate-punctate with rest of head and dorsum of mesosoma distinctly, rather regularly, longitudinally striate, opaque. Sides of mesosoma wrinkled; petiole finely reticulate. Tips of pronotal and petiolar spines smooth, highly polished. Gaster rather distinctly reticulate-punctate, opaque.



Figs 19-26. *Polyrhachis aculeata*-group spp: (19, 21) head in full face view; (20, 22) petiole in frontal view; (23, 25) dorsal view; (24, 26) lateral view. (19-20, 23-24) *P. alatisquamis* Forel (holotype); (21-22, 25-26) *P. pubescens* Mayr (not to scale).

Mandibular masticatory borders and outer margins with numerous, suberect, golden hairs. Anterior clypeal margin medially with a few anteriorly directed, golden setae and fringe of very short setae laterally. Numerous relatively long, erect or suberect, pale golden hairs on clypeus, along frontal carinae, vertex and sides of head; moderately long, suberect hairs lining superior edge of antennal scapes. Somewhat less abundant and shorter hairs on dorsum of mesosoma and petiole; hairs distinctly

more abundant on gaster, with notably longer hairs towards gastral apex and on venter. Closely appressed, relatively long, white or greyish pubescence abundant over most body surfaces and almost completely hiding underlying sculpturation; pubescence less abundant on antennal scapes and legs and completely absent from mandibles and tips of spines.

Colour. Black; antennae, legs and gastral venter and apex dark to very dark reddish brown; mandibular masticatory borders and teeth a shade lighter.

Sexuals and immature stages unknown.

Remarks. Closely similar to *P. pubescens* but differing by its generally smaller size, more slender body, distinctly less convex eyes and more strongly transverse dorsum of the petiole.

***Polyrhachis pubescens* Mayr, 1879**

(Figs 21-22, 25-26)

Polyrhachis pubescens Mayr, 1879: 657. Neotype worker (by present designation).

Type locality: WEST MALAYSIA: Selangor, Ulu Gombak, 15.xii.2004 (Fuminori Ito, FI 04-49), QMBA (examined).

Hemioptica (Hemioptica) pubescens Mayr; Bingham, 1903: 381. Combination in *Hemioptica* Roger.

Polyrhachis (Myrma) pubescens Mayr; Emery, 1925: 205. Combination in *P. (Myrma)*.

Polyrhachis (Myrma) pubescens Mayr; Dorow & Kohout, 1995: 94.

Neotype designation. *Polyrhachis pubescens* was originally described from a single worker collected in 'Ostindien'. The specimen was presented to Mayr by Prof. Schmidt-Göbel and, like that of *P. aculeata*, the holotype should be lodged in the Mayr collection in Vienna (NHMW). However, in spite of an extensive search, the specimen cannot be located there or in any other collection examined and is considered lost. To establish the nomenclatural stability of the species, I here designate, in accordance with Article 75.3.5 of the *International Code of Zoological Nomenclature* (Fourth Edition: 1999), a worker specimen as the neotype of *Polyrhachis pubescens* Mayr. The specimen was selected from a nest series that also includes queens and a male, with part of the colony donated to QMBA, where the neotype has also been deposited. The specimen bears the following label: 'FI 04-49, Ulu Gombak, W-Malaysia, 15.xii.2004, ITO Fuminori', plus an additional red label: 'NEOTYPE, QMT 183497, *Polyrhachis pubescens* Mayr, 1879, designated by R.J. Kohout, 2013'.

Additional material examined. SOUTHERN THAILAND: Yala Prov., Betong, Piyamit Village, 750-950 m, 6.i.2006, rf. edge (N. Naw) (w). WEST MALAYSIA: Selangor, Gombak Research Centre, i-ii.1989 (M. Edmunds) (w); Ulu Gombak, 15.xii.2004 (Fuminori Ito, FI 04-49) (w, ♀, ♂). BORNEO, SABAH: Kinabalu Park, Poring, 06°3'N, 116°42'E, 500 m, 19.ix.2006, fogging (A. Floren) (w).

Worker. Dimensions: TL c. 6.05-7.31; HL 1.59-1.72; HW 1.22-1.34; CI 75-79; SL 2.00-2.18; SI 156-169; PW 1.18-1.25; MTL 1.96-2.09 (11 measured).

Queen (not previously described). Dimensions: TL c. 7.61-7.71; HL 1.72; HW 1.34-1.37; CI 78-79; SL 2.09; SI 152-156; PW 1.56-1.59; MTL 2.03-2.09 (2 measured).

Queen larger than worker with usual characters identifying full sexuality, including three ocelli, complete thoracic structure and wings. Pronotal spines shorter. Mesoscutum wider than long; lateral margins converging anteriorly into moderately rounded anterior margin; median line distinct, bifurcate anteriorly; parapsides flat, only weakly raised posteriorly; mesoscutum in profile with relatively low anterior face and posteriorly flat dorsum. Mesoscutellum only weakly convex, not elevated above dorsal plane of mesosoma. Propodeal dorsum weakly convex in outline, with lateral margins somewhat angular at midlength and terminating in short ridges that extend medially, forming transverse carina dividing propodeal dorsum from concave declivity. Petiole with dorsal margin convex, dorsolaterally armed on each side with two teeth of virtually equal length. Sculpturation, pilosity, pubescence and colour very similar to worker.

Males and immature stages in private collection of Fuminori Ito.

Remarks. *Polyrhachis pubescens* is recorded from India, Myanmar, Thailand and West Malaysia. Only very recently it has been identified from Borneo (Sabah); it was not included by Wheeler (1919) or Kohout (in Pfeiffer *et al.* 2011) in their lists of Bornean ants. The specimens from Kinabalu Park in Sabah are very similar to material from continental Malaysia and differ mainly in their marginally larger size (HL >1.68 in Bornean specimens versus <1.68 in continental specimens). The longitudinal body striation is also more distinct, due to the somewhat less abundant silvery pubescence which, in continental specimens, is richer and partly obscures the underlying sculpturation.

***Polyrhachis palawanensis* sp. nov.**

(Figs 27-31)

Type. *Holotype* worker, PHILIPPINES, PALAWAN: Mantalingajan Ra., Pingisan, 620 m, H. Holtmann (worker). Type deposition: Holotype in MCZC.

Description. Worker. Dimensions: TL c. 6.60; HL 1.62; HW 1.31; CI 81; SL 2.06; SI 157; PW 1.28; MTL 2.00 (1 measured).

Mandibles with 5 teeth. Anterior clypeal margin arcuate, distinctly truncate medially, truncate portion delimited laterally by blunt angles. Clypeus with poorly indicated median carina; virtually straight in profile, posteriorly rounding into moderately impressed basal margin. Frontal triangle poorly indicated. Frontal carinae sinuate, margins only moderately raised; central area flat with rather short frontal furrow. Sides of head in front of eyes convex towards mandibular bases; behind eyes sides strongly converging towards rather narrow occipital margin. Eyes very prominent, virtually flat, strongly projecting laterally, resembling blinkers, outline somewhat angular in full face view (Fig. 27); flatness of eyes notably evident when viewed from

behind (Fig. 28). Ocelli lacking. Pronotal dorsum armed with relatively long spines, about 2x as long as basal width; pronotal margins subparallel, rounding posteriorly into promesonotal suture that is distinctly impressed laterally and rather flat medially. Mesonotal lateral margins narrowly rounded and raised anteriorly, posteriorly rounding into laterally impressed, medially indistinct, metanotal groove. Propodeal dorsum with lateral margins distinctly converging posteriorly and terminating in narrowly rounded, dorsally raised ridges that are continued medially and form transverse, dorsally bowed carina separating propodeal dorsum from virtually vertical, concave declivity. Secondary carinae extending from propodeal margins towards propodeal spiracles, dividing declivity from sides of propodeum. Petiole biconvex in profile; dorsum strongly transverse with weakly convex dorsal margin armed with pair of dorsolaterally and posteriorly directed spines situated on dorsolateral angles of petiole; shorter, rather flat, secondary spine situated laterally at base of each spine (Fig. 29). Anterior face of first gastral segment concave to accommodate posterior face of petiole; anterior margin only narrowly rounding onto dorsum.

Mandibles distinctly, longitudinally striate with piliferous pits. Clypeus reticulate-punctate with rest of head and dorsum of mesosoma, including spines, distinctly, rather regularly, longitudinally striate, opaque. Sides of mesosoma wrinkled; petiole finely reticulate. Tips of pronotal and petiolar spines smooth, polished. Gaster distinctly, rather closely reticulate-punctate, opaque.

Mandibular masticatory borders and outer margins with numerous, suberect, golden hairs. Anterior clypeal margin medially with a few anteriorly directed golden setae and few shorter setae fringing margin laterally. Numerous relatively long, erect or suberect, mostly silvery or whitish hairs on clypeus, along frontal carinae, vertex and sides of head; moderately long, suberect hairs lining superior edge of antennal scapes with only a few distinctly shorter hairs along inferior edge. A few shorter, silvery hairs on sides of pronotum and fore coxae; more abundant, somewhat longer, pale golden hairs on legs. Hairs virtually absent from dorsum of mesosoma and petiole. Several moderately long, pale golden hairs on dorsum of gaster, distinctly longer and more abundant hairs on gastral venter and around apex. Closely appressed, relatively long, white or greyish pubescence abundant over most body surfaces and almost completely hiding underlying sculpturation; pubescence somewhat less abundant on antennal scapes and legs and completely absent from mandibles and tips of spines.

Colour. Black; mandibular masticatory borders lined with reddish brown. Antennae, legs and gastral apex dark to medium reddish brown.

Sexuals and immature stages unknown.

Etymology. Named after the type locality, Palawan Island in the Philippines.

Remarks. *Polyrhachis palawanensis* closely resembles *P. pubescens* and *P. alatisquamis*. All have short to medium length, semierect to erect, bristle-like hairs and abundant, relatively long, silvery, appressed pubescence. *Polyrhachis palawanensis* and *P. alatisquamis* both have a transversely broad petiole distinguishing them from *P. pubescens* (Fig. 29). In addition, *P. palawanensis* has unusually flat, posteriorly protracted eyes (Figs 27, 28), which distinguish it from both of the above species.



Figs 27-31. *Polyrhachis aculeata*-group spp: (27) head in full face view; (28) oblique view of head from behind; (29) petiole in frontal view; (30); dorsal view; (31) lateral view. (27-31) *P. palawanensis* sp. nov. (holotype). (not to scale).

***Polyrhachis diana* Wheeler, 1909**

(Figs 32-33, 36-37)

Polyrhachis diana Wheeler, 1909: 343. Syntype workers. Type locality: PHILIPPINES, MINDANAO, Butuan, 19.xii.1907 (H.M. Smith), AMNH, MCZC (Co-type 22958) (examined).

Polyrhachis (*Myrma*) *diana* Wheeler; Emery, 1925: 201. Combination in *P. (Myrma)*.

Additional material examined. PHILIPPINES, LUZON: Manila (as Manille) (Baer) (w); Manila (no further data); Los Baños (Baker) (♀); LUZON: 29.ix.1945 (H.E. Milliron) (w); NEGROS ORIENTAL: Dumaguete (J.W. Chapman) (♀).

Worker. Dimensions (syntypes cited first): TL c. 6.35-7.16, 6.35-7.16; HL 1.65-1.72, 1.65-1.72; HW 1.25-1.31, 1.25-1.34; CI 76-77, 76-80; SL 2.06-2.18, 2.06-2.18; SI 161-167, 160-167; PW 1.28-1.31, 1.28-1.31; MTL 2.03-2.12, 2.03-2.12 (5+2 measured).

Queen (two queen specimens in MCZC collection).

Males and immature stages unknown.

Remarks. When describing *P. diana*, Wheeler (1909) noted it was closely related to *P. latona*, described from Taiwan in the same paper. He listed the more abundant and silvery pubescence, shorter thorax and the different shape of the petiole and its associated spines as characters distinguishing *P. diana*

from *P. latona*. In addition to these characters, *P. diana* also differs from *P. latona* by its more distinct sculpturation of the head (Figs 32, 36) and mesosoma, more convex eyes, notably when viewed from behind, and transversely broader petiolar node, which lacks the intercalary tooth (Fig. 33) that is rather prominent in *P. latona* (Fig. 35). *Polyrhachis diana* is also similar to *P. murina* Emery, a species originally described from Borneo and the Philippines. *Polyrhachis murina* differs by its distinctly shorter pronotal spines (Fig. 44), much finer sculpturation of the mesosomal dorsum and by having the lateral petiolar teeth extended into short spines (Fig. 41).

***Polyrhachis latona* Wheeler, 1909**

(Figs 33-34, 38-39)

Polyrhachis latona Wheeler, 1909: 337. Syntype workers. Type locality: TAIWAN (as Formosa), Takao (H. Sauter), AMNH, MCZC (Type 21662) (examined).

Polyrhachis (Myrma) latona Wheeler; Emery, 1925: 201. Combination in *P. (Myrma)*.

Polyrhachis latona v. *dorsorugosa* Forel, 1913: 202. Syntype workers, male. Original localities: TAIWAN (as Formosa), Kankau (Koshun) (H. Sauter); Chip-Chip (H. Sauter), MHNG (examined).

Polyrhachis dorsorugosa Forel; Wang & Wu, 1991: 599, 601. Raised to species.

Polyrhachis dorsorugosa Forel; Wu & Wang, 1995: 167, 201. Junior synonym of *P. latona*.

Additional material examined. TAIWAN: Taipei, Ankung, 8.viii.1992 (D.G. Furth) (w); Huan Tao Chi, nr Pu Li, c. 660 m, 24.x.1960 (A.C.F. Hung) (w); ditto, 21.vi.1962 (A.C.F. Hung) (w). CHINA: Chusan Is (J.J. Walker) (w). HONG KONG, N.T.: Tai Po Kau for., tree fern stump, 29.x.1980 (R. Winney) (w). JAPAN: Ryukyu Is, Miyako Group, Erabu, 6.ix.1951 (F.G. Werner) (w). N. VIETNAM: Cuo Phang Forest, 295 m, 23.viii.1981 (P. Jolivet) (w).

Worker. Dimensions (syntypes cited first): TL c. 6.25-7.16, 6.30-7.26; HL 1.62-1.72, 1.65-1.84; HW 1.22-1.31, 1.26-1.34; CI 75-76, 73-78; SL 1.96-2.06, 2.03-2.21; SI 157-161, 156-166; PW 1.18-1.34, 1.25-1.40; MTL 1.93-2.09, 2.00-2.25 (2+10 measured).

Queen (not previously described). Dimensions: TL c. 8.62; HL 1.90; HW 1.42; CI 75; SL 2.25; SI 158; PW 1.78; MTL 2.31 (1 measured).

Queen larger than worker with usual characters identifying full sexuality, including three ocelli, complete thoracic structure and wings. Pronotal spines very short, about as long as basal width. Mesoscutum only marginally wider than long; lateral margins converging anteriorly into rather narrowly rounded anterior margin; median line distinct; parapsides virtually flat; mesoscutum in profile with anterior face widely rounding onto convex dorsum. Mesoscutellum weakly convex, not distinctly elevated above dorsal plane of mesosoma. Propodeum with lateral margins in profile somewhat angular at midlength, terminating in short ridges that are continued medially forming distinct, dorsally bowed carina dividing propodeal dorsum from declivity. Petiole with dorsolateral and lateral spines subequal in length; dorsal margin

with distinct intercalary tooth. Sculpturation, pilosity, pubescence and colour very similar to worker.



Figs 32-39. *Polyrhachis aculeata*-group spp: (32, 34) head in full face view; (33, 35) petiole in frontal view; (36, 38) dorsal view; (37, 39) lateral view. (32-33, 36-37) *P. diana* Wheeler; (33-34, 38-39) *P. latona* Wheeler (not to scale).

Male in MHNG collection. Immature stages unknown.

Remarks. When describing *P. latona*, Wheeler (1909) noted that his new species 'is closely related to *P. relucens* Latr., *mayri* Roger [= *P. illaudata* Walker] and *proxima* Roger'. He listed the smaller size, more approximate frontal carinae, different pilosity, shallower promesonotal and 'mesoëpinotal' notches in the lateral margins, differences in the shape and length of the pronotal and petiolar spines and several other characters as the main differences distinguishing his new species. Besides the characters indicated by Wheeler, *P. latona* also differs from the above species by having rather flat, mildly posteriorly protracted eyes.

***Polyrhachis murina* Emery, 1893**

(Figs 40-41, 44-45)

Polyrhachis murina Emery, 1893: 198. Lectotype worker (by present designation).

Original localities: BORNEO, SARAWAK (Bedot); PHILIPPINES, Jolo (MSNG) (examined).

In his original description of *P. murina*, Emery (1893) listed Sarawak in Borneo and Jolo in the Philippines as localities for his new species, evidently considering specimens from both locations to be conspecific. I have examined two syntype workers of *P. murina* from Sarawak in the Emery collection in Genova (MSNG), both bearing identical labels as follows: 'Sarawak, Bedot' and '*Polyrhachis murina* Emery'. I have also examined three additional specimens from Sumatra, deposited in the general collection of that museum and labelled '*P. murina* teste Emery', and several specimens identified as *P. murina* from the Philippines. This examination has shown that specimens from the Philippines stand well apart from the syntypes of *P. murina* from Sarawak, with a number of characters exceeding the variability that would be expected between different populations of a single biological species. I therefore believe that the Philippine specimens represent a different species from *P. murina*, which is described below as *P. starri*.

Lectotype designation. To establish the nomenclatural stability of *Polyrhachis murina* and to prevent any future selection of a lectotype from specimens other than those from Sarawak, I here designate, in accordance with Article 74.7.3 of the *International Code of Zoological Nomenclature* (1999), one of the syntype workers from Sarawak mentioned above as the lectotype of *Polyrhachis murina* Emery, 1893. The specimen is lodged in the Emery collection (MSNG) and, in addition to the labels listed above, it now also bears a red tag: 'Lectotype, *Polyrhachis murina* Emery, 1893, designated by R.J. Kohout, 2013'. The remaining specimens of the original series consequently become paralectotypes and are labelled accordingly.

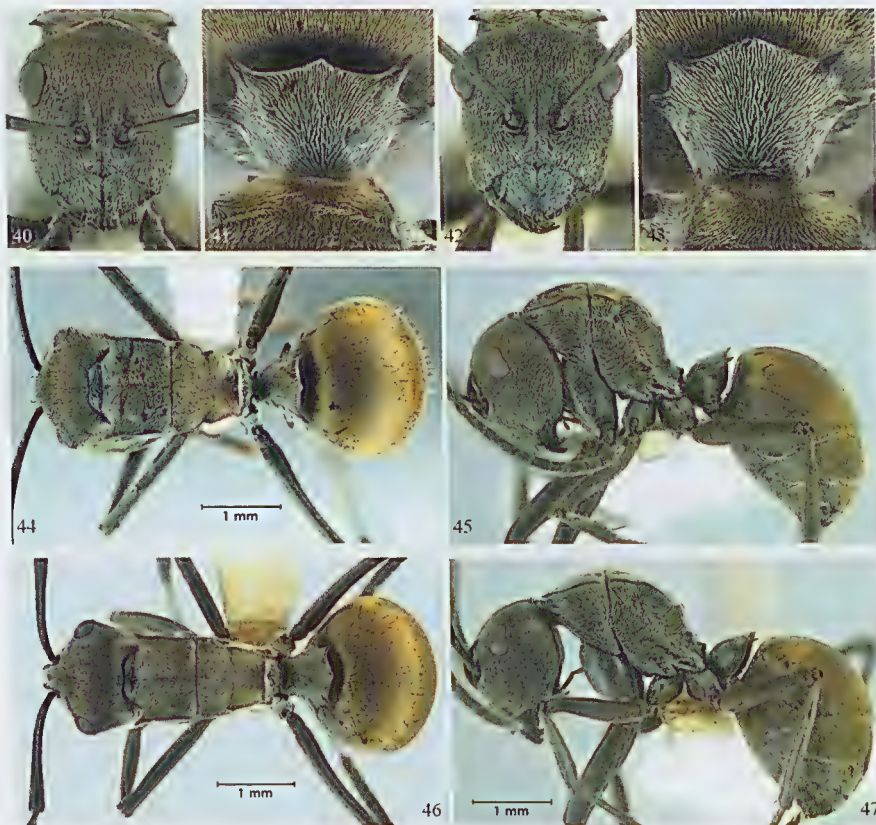
Additional material examined. BORNEO, SABAH: Kota Kinabalu, 05°59'N, 116°04'E, 20 m, 9.x.1978, relict rf. (B.B. Lowery) (w); SARAWAK: Bau Distr., Bidi, 90-240 m, 31.viii.1958, rf. (T.C. Maa) (w). INDONESIA, SUMATRA: Pea Ragia, x.1890 (E. Modigliani) (w); Pangherang-Pisang, x.1890 and iii.1891 (E. Modigliani) (w); Siboga, x.1890 and iii.1891 (E. Modigliani) (w).

Worker. Dimensions (lectotype cited first): TL c. 6.75, 6.55-7.00; HL 1.78, 1.75-1.87; HW 1.40, 1.34-1.43; CI 79, 75-79; SL 2.21, 2.12-2.31; SI 158, 158-165; PW 1.22, 1.15-1.28; MTL 2.21, 2.12-2.31 (1+4 measured).

Sexuals and immature stages unknown.

Remarks. *Polyrhachis murina* is morphologically a relatively stable species with specimens from Borneo and Sumatra closely comparable. Apart from some differences in the length of the pronotal spines, length and shape of the lateral petiolar spines and colour of the pubescence, which ranges from

golden to silvery or just dull greyish, I found them all very similar and undoubtedly conspecific.



Figs 40-47. *Polyrhachis aculeata*-group spp: (40, 42) head in full face view; (41, 43) petiole in frontal view; (44, 46) dorsal view; (45, 47) lateral view. (40-41, 44-45) *P. murina* Emery; (42-43, 46-47) *P. starri* sp. nov. (holotype) (not to scale).

***Polyrhachis starri* sp. nov.**

(Figs 42-43, 46-47)

Types. *Holotype* worker, PHILIPPINES, LUZON: Camarines Sur, Sibao, Carolina, Naga City, 29.xii.1982, C. Starr (worker). *Paratypes*: data as for holotype (2 workers). **Type distribution:** Holotype in QMBA (QMT 189650); 1 paratype each in BMNH and MCZC.

Additional material examined. PHILIPPINES, PALAWAN: Brooke's Pt, Macagua, 75 m, 27-31.iii.1962 (H. Holtmann) (w); LUZON: Los Baños (F.X. Williams) (w); Boguio (F.X. Williams) (w); Laguna, Majayjay (no further data) (w); Banahao (Baker) (w); NEGROS ORIENTAL: Dumaguete, 11.ix.1948 (Domingo Empeso) (w); MINDANAO: Mt Apo, 5-6000ft (C.F. Clagg) (w).

Worker. Dimensions (holotype cited first): TL c. 6.75, 6.25-6.80; HL 1.81, 1.72-1.81; HW 1.37, 1.25-1.37; CI 76, 73-76; SL 2.15, 2.09-2.15; SI 157, 155-167; PW 1.09, 1.03-1.15; MTL 2.21, 2.06-2.21 (1+4 measured).

Anterior clypeal margin arcuate, medially very narrowly truncate. Clypeus with posteriorly raised median carina; in profile with shallow depression medially, posteriorly rounding into virtually flat basal margin. Frontal triangle distinct. Frontal carinae sinuate with moderately raised margins; central area with distinct frontal furrow. Sides of head in front of eyes almost straight, before rounding into mandibular bases; behind eyes sides rounding into relatively narrow occipital margin. Eyes moderately convex; in full face view clearly breaking lateral cephalic outline; eyes. Ocelli lacking. Pronotal dorsum with rather short spines, as long as their basal width or marginally longer; lateral edges of spines continuous with subparallel pronotal margins. Promesonotal suture distinctly impressed laterally, rather flat medially; mesonotal dorsum transverse, about 2x as wide as long, lateral margins converging posteriorly before rounding into metanotal groove that is poorly indicated medially. Propodeal dorsum with lateral margins converging posteriorly and terminating in weakly raised, blunt teeth, with dorsum between them descending into oblique declivity in medially uninterrupted line; short, rather blunt carinae extend from lateral propodeal margins towards distinct propodeal spiracles, dividing declivity from sides of propodeum. Petiole biconvex in lateral view, with dorsal margin raised and bluntly angular medially; dorsolateral spines relatively short, about as long as secondary spine situated laterally below base of each spine (Fig. 43). Anterior face of first gastral segment concave to accommodate posterior face of petiole.

Mandibles distinctly, longitudinally striate, with piliferous pits. Clypeus reticulate-punctate with rest of head rather finely longitudinally striate. Dorsum of mesosoma and petiole finely reticulate-punctate; sides of mesosoma wrinkled. Gaster closely reticulate-punctate.

Mandibular masticatory borders and outer margins with numerous curved, golden hairs. Anterior clypeal margin with a few anteriorly directed setae medially and fringe of shorter setae lining margin laterally. A few paired, erect, golden hairs on clypeus and along frontal carinae; several longer hairs on fore coxae. Gaster with numerous posteriorly inclined, golden hairs on venter and around apex. No hairs on vertex of head, dorsum of mesosoma, petiole, antennal scapes and legs. Closely appressed, silvery pubescence rather diluted on clypeus, more abundant on rest of head and notably on dorsum of mesosoma and petiole, where it completely hides underlying sculpturation. Pubescence distinctly longer and golden on gastral dorsum, silvery on gastral venter.

Colour. Black; legs black or very dark reddish brown.

Queen. Dimensions: TL c. 8.47; HL 2.06; HW 1.59; CI 77; SL 2.28; SI 143; PW 1.87; MTL 2.50 (1 measured).

Queen distinctly larger than worker with usual characters identifying full sexuality, including three ocelli, complete thoracic structure and wings. Pronotal spines distinctly shorter, tooth-like, with posterior lateral margins widely rounded. Mesoscutum marginally wider than long; lateral margins converging anteriorly into broadly rounded anterior margin; median line distinct, bifurcate anteriorly; parapsides

flat, only weakly raised posteriorly; mesoscutum in profile with anterior face widely rounding onto posteriorly flat dorsum. Mesoscutellum only weakly convex, not elevated above dorsal plane of mesosoma. Propodeum convex in outline with rather blunt lateral margins terminating posteriorly in indistinct, medially directed, short ridges; propodeal dorsum between ridges descending into propodeal declivity in medially uninterrupted line. Petiole with dorsal margin bluntly angular medially and dorsal spines reduced to obtuse teeth; dorsolaterally situated secondary spines relatively long and acute. Sculpturation, pilosity and colour scheme very similar to worker, except pubescence on dorsum of mesosoma with somewhat golden tint.

Etymology. Named after the collector of the type series, Dr Chris K. Starr of the University of the West Indies, Trinidad & Tobago, for his generous donations of many *Polyrhachis* ants collected during his tenure as an Associate Professor at De La Salle University in the Philippines.

Remarks. Although *Polyrhachis starri* closely resembles *P. murina*, close examination and comparison of the available specimens has revealed a number of distinguishing characters. *Polyrhachis starri* is generally more slender (PW <1.15 versus >1.15 in *murina*), with the mesosoma longer and only moderately convex in outline (Fig. 47), the profile of the clypeus shallowly impressed medially and the petiole with its dorsal margin raised and bluntly angular medially and armed with distinctly shorter dorsolateral spines (Fig. 43). In contrast, in *P. murina* the mesosoma is wider and shorter, with the dorsum distinctly more convex in outline (Fig. 45), the profile of the clypeus is virtually straight and the petiole has its dorsal margin only weakly raised and armed with a distinct intercalary tooth and longer dorsolateral spines (Fig. 41). In addition, the head of *P. murina* has numerous short, erect hairs between the eyes and occipital corners that are totally absent in *P. starri*. As mentioned above, when describing *P. murina*, Emery (1893) considered specimens from Sarawak and Philippines (Jolo) to be conspecific. However, following their comparison I believe they represent separate species, *P. starri* from the Philippines and *P. murina* from Borneo and Sumatra.

***Polyrhachis numeria* Fr. Smith, 1861**

(Figs 48, 51-52)

Polyrhachis numeria Fr. Smith, 1861: 42, pl. 1, fig. 25. Holotype worker. Type locality: INDONESIA, SULAWESI (A.R. Wallace), OUMNH (examined).

Polyrhachis (Myrma) numeria Fr. Smith; Emery, 1925: 201. Combination in *P. (Myrma)*. Type locality cited erroneously as 'Halmahera'.

Polyrhachis (Johnia) schizospina Karavaiev, 1927: 44, fig. 20. Holotype queen. Type locality: INDONESIA, Prinsen Island in Sunda Strait (Karavaiev #2397) IZAS (examined). Synonymy by Kohout, 1998: 527.

Polyrhachis (Aulacomyrma) schizospina Karavaiev; Hung, 1967: 402. Combination in *P. (Aulacomyrma)*.

Worker. Dimensions (holotype): TL c. 6.50; HL 1.65; HW 1.28; CI 77; SL 2.03; SI 158; PW 1.34; MTL 1.96.

Queen. Dimensions (*P. schizospina* holotype): TL c. 7.96; HL 1.81; HW 1.40; CI 77; SL 2.12; SI 151; PW 1.52; MTL 2.18.

Male and immature stages unknown.

Remarks. *Polyrhachis numeria* appears to be a rare species and, in spite of examination of several collections gathered during the 1985 'Project Wallace' by N.E. Stork and M.J.D. Brendell (BMNH), C. van Achterberg (RMNH) and subsequently by other collectors, namely B. Gobin (KULB), K. Ogata & K. Masaoka (ITAK), I. Ketterl (SMNS), J. Constant (IRSN), M.M. Bos (GUGG) and S. Yamane (KUKJ), the holotype is the only specimen recorded from Sulawesi. This species is superficially very similar to *P. diana* described by Wheeler (1909) from Mindanao. However, recent examination and direct comparison of the *P. diana* syntypes with the holotype of *P. numeria* indicate that they are distinct species. In *P. numeria* the eyes are weakly posteriorly truncate, the superior edge of antennal scapes has numerous, relatively short hairs and all dorsal body surfaces have rather abundant, moderately long, golden hairs. In contrast, the eyes in *P. diana* are normal, the antennal scapes lack hairs and the body pilosity is confined to the front of the head and venter and apex of the gaster. Also, the pronotal spines in *P. numeria* are somewhat shorter with broad and dorsally flat bases, while they are longer and more slender with distinctly dorsomedially flattened bases in *P. diana*.

***Polyrhachis selecta* Forel, 1911, stat. nov.**

(Figs 49-50, 53-54)

Polyrhachis murina ssp. *selecta* Forel, 1911: 215. Syntype workers, male. Original localities: INDONESIA, JAVA, Samarang, Sept. 1909 (E. Jacobson) (w); Melambong, Juli 1909 (E. Jacobson) (♂), MNHG (examined).

Polyrhachis (*Myrma*) *murina selecta* Forel; Emery, 1925: 205. Combination in *P. (Myrma)*.

Worker. Dimensions (syntype): TL c. 6.65; HL 1.78; HW 1.37; CI 77; SL 2.18; SI 159; PW 1.37; MTL 2.25 (1 measured).

Queen and immature stages unknown. Male in MNHG collection.

Remarks. The syntypes of *P. selecta* are the only available specimens of this species. Their direct comparison with syntypes of *P. murina* Emery has shown these taxa differ in numerous characters and I consider they are distinct species. *Polyrhachis selecta* features well developed pronotal spines, more than twice as long as their basal width, a distinctly longitudinally striate mesosomal dorsum and long and slender dorsal petiolar spines. In contrast, in *P. murina* the pronotal spines are very short, barely as long as their basal width, the mesosomal dorsum is finely reticulate-punctate, with the

sculpturation partly hidden by closely appressed silvery or pale golden pubescence, and the dorsal petiolar spines are shorter, less than twice as long as their basal width.



Figs 48-54. *Polyrhachis aculeata*-group spp: (48, 49) head in full face view; (50) petiole in frontal view; (51, 53) dorsal view; (52, 54) lateral view. (48, 51-52) *P. numeria* Fr. Smith (holotype images courtesy of AntWeb.org – casent0901872); (49-50, 53-54) *P. selecta* Forel (syntype) (not to scale).

***Polyrhachis kebunraya* sp. nov.**

(Figs 55-56, 59-60)

Types. Holotype worker, INDONESIA, JAVA: Bogor, Kebun Raya, 06°35'S, 106°47'E, 290 m, 7-12.ix.1999, S.K.A. Robson #825 (worker). *Paratypes:* Bogor, Kebun Raya, xii.1990 (F. Ito) (2 workers). Type deposition: Holotype in QMBA (QMT 183499); 1 paratype each in BZMI and SKYC.

Description. Worker. Dimensions (holotype cited first): TL c. 7.31, 7.21-7.31; HL 1.84, 1.81-1.87; HW 1.34, 1.31-1.37; CI 73, 72-73; SL 2.37, 2.34-2.40; SI 177, 175-179; PW 1.28, 1.25-1.31; MTL 2.43, 2.40-2.50 (1+2 measured).

Mandibles with 5 teeth. Anterior clypeal margin arcuate, narrowly medially truncate. Clypeus with blunt median carina, virtually straight in profile, posteriorly rounding into rather shallowly impressed basal margin. Frontal triangle distinct. Frontal carinae sinuate with strongly raised margins; central area narrow with distinct median furrow. Sides of head in front of eyes converging towards mandibular bases in evenly convex line; behind eyes sides produced into short, blunt carina extending towards occipital corners. Eyes distinctly convex, strongly posteriorly truncate, in full face view clearly breaking lateral cephalic outline. Ocelli lacking. Dorsum of mesosoma evenly convex in profile; pronotal humeri armed with rather long, acute spines; dorsum of each spine with longitudinal carina running from base towards tip; outer edge of spine acute, smoothly merging with lateral margin of pronotal dorsum. Promesonotal suture distinct, but relatively flat. Mesonotal dorsum with lateral margins narrowly rounded and weakly raised anteriorly, widely rounded and flat posteriorly; metanotal groove impressed laterally, indistinct medially. Propodeal dorsum with lateral margins distinctly converging posteriorly and terminating in narrowly rounded, moderately raised ridges that continue medially and merge, forming straight transverse carina dividing propodeal dorsum from shallowly concave declivity; secondary carinae extends from propodeal margins towards propodeal spiracles, dividing declivity from sides of propodeum. Petiole biconvex in profile, armed with a pair of dorsolaterally and posteriorly directed, acute spines situated on dorsolateral angles of petiole; bases of spines close to posterior face of petiole with dorsal margin of petiole clearly visible in lateral view (Fig. 60); shorter, dorsally emarginate, tooth situated laterally below base of each spine. Anterior face of first gastral segment concave to accommodate posterior face of petiole, anterodorsal margin distinctly lower than full height of petiolar node.

Mandibles finely, longitudinally striate with numerous piliferous pits. Clypeus finely reticulate-punctate, sculpture on dorsum and sides of head distinctly longitudinally organised. Dorsum of mesosoma finely longitudinally striate, striae more prominent on pronotal spines and along lateral mesosomal margins; petiole and gaster very finely reticulate-punctate. Tips of pronotal and petiolar spines highly polished; propodeal declivity, petiole and gaster finely shagreened, semipolished. Mandibles along masticatory and outer borders with semierect, relatively short, golden hairs. Anterior clypeal margin with a few rather long, anteriorly directed, golden setae medially and few very short setae laterally. Numerous moderately long, erect, golden hairs on clypeus, along frontal carinae and a few shorter hairs on vertex; several shorter hairs along superior edge of antennal scapes. Hairs totally absent from dorsum of mesosoma and petiole. Only a few moderately long hairs on anterior and posterior faces of fore coxae. Gaster with numerous posteriorly directed hairs around apex and on venter.

Colour. Black throughout, only extreme tip of apical funicular segment reddish brown.

Sexuals and immature stages unknown.



Figs 55-62. *Polyrhachis aculeata*-group spp: (55, 57) head in full face view ; (56) petiole in frontal view; (58) base of antennal scape; (59, 61) dorsal view; (60, 62) lateral view. (55-56, 59-60) *P. kebunraya* sp. nov. (holotype); (57-58, 61-62) *P. watanasiti* sp. nov. (holotype) (not to scale).

Etymology. Named after the type locality, Bogor Botanical Gardens, popularly known as Kebun Raya.

Remarks. *Polyrhachis kebunraya* is most similar to *P. dimoculata*, described above, from Borneo. They share the fine reticulate-punctate sculpturation of the dorsal body surfaces, distinctly striate pronotal spines, including their bases, and a virtual lack of pilosity on the vertex of the head, dorsum of the mesosoma, petiole and dorsum of the gaster. However, the sculpture on the dorsum of the head and mesosoma in *P. kebunraya* is distinctly longitudinally directed and covered with a very fine pile of closely appressed pubescence that is completely lacking in *P. dimoculata*. The truncate eyes in *P. kebunraya* are distinctly more convex and more protracted posteriorly and the sides of head behind the eyes are produced into short, blunt, carinae that

are absent in *P. dimoculata*. Also, the antennal scapes in *P. kebunraya* have several hairs along their superior edge that are completely lacking in *P. dimoculata*.

Polyrhachis kebunraya appears to be restricted to the type locality and is known only from the specimens collected by Simon Robson and Fuminori Ito.

***Polyrhachis watanasiti* sp. nov.**

(Figs 57-58, 61-62)

Type. Holotype worker, SOUTHERN THAILAND: Center Ranong Prov., Ngao Mangrove For., 24.x.2003, mangroves, N. Naw (worker). Type distribution: Holotype in QMBA (QMT 189651).

Worker. Dimensions: TL c.6.85; HL 1.75; HW 1.28; CI 73; SL 2.31; SI 180; PW 1.18; MTL 2.28.

Anterior clypeal margin arcuate, medially obtusely truncate. Clypeus with blunt, poorly indicated median carina; clypeus straight in profile with rather flat basal margin. Frontal triangle distinct. Frontal carinae very closely approximate anteriorly with sharply raised, almost vertical margins; central area very narrow with distinct frontal furrow. Antennal scapes with bases distinctly broadened (Fig. 58). Sides of head in front of eyes converging towards mandibular bases in even convex line; behind eyes sides rounding into moderately convex occipital margin. Eyes truncate posteriorly, in full face view clearly exceeding lateral cephalic outline. Ocelli lacking. Pronotal dorsum with slender, anterolaterally directed, acute spines, about 3x as long as basal width; outer edges of spines acute and basally continuous with virtually parallel pronotal margins, promesonotal suture distinctly impressed laterally, rather flat medially. Mesonotal lateral margins narrowly rounded and distinctly raised anteriorly, rather flat posteriorly before converging into medially flat metanotal groove. Propodeum with lateral margins distinctly converging posteriorly and terminating in distinct, upturned ridges that meet medially and form transverse carina dividing propodeal dorsum from shallowly concave declivity. Petiole biconvex in profile; transversely broad, convex dorsal margin armed with moderately long, dorsolaterally directed and outwardly curved spines; lateral margins of petiole with secondary, shorter, somewhat dorsally flattened tooth below each spine. Anterior face of first gastral segment concave to accommodate posterior face of petiole; anterodorsal margin narrowly rounding onto dorsum.

Mandibles finely, mostly longitudinally striate with piliferous pits. Clypeus and rest of head reticulate-punctate with sculpture on vertex and sides of head somewhat longitudinally directed; pronotal spines longitudinally striate, striae continued onto lateral margins of pronotum; mesosomal and propodeal dorsa striate medially. Petiole and gaster finely reticulate-punctate, opaque.

Mandibular masticatory and outer borders with numerous curved, golden hairs. Anterior clypeal margin with a few anteriorly directed setae medially. Numerous rather long hairs on clypeus, front and vertex of head, many breaking lateral cephalic outline. Antennal scapes with several shorter hairs along superior edge. Dorsum of mesosoma with only a few very short, bristle-like hairs on pronotal dorsum; several

longer hairs on fore coxae and along subpetiolar process; no hairs on mesonotal and propodeal dorsa, petiole and legs. Gaster with numerous hairs on venter and towards apex. Closely appressed, silvery pubescence distributed in various densities over whole body, partly obscuring underlying sculpturation on head, dorsum of mesosoma and sides of petiole and gaster.

Colour. Black, virtually throughout; only condyla of scape and extreme tip of apical funicular segment reddish brown.

Sexuals and immature stages unknown.

Etymology. Named after Prof. Dr Suparoek Watanasit of Prince of Songkla University, Hat Yai, Thailand, for his generous support during my visit to southern Thailand.

Remarks. *Polyrhachis watanasiti* is very similar to *P. pubescens* but differs in having the bases of the antennal scapes distinctly broadened and flattened (Fig. 58) and the body pubescence greatly reduced.

Acknowledgements

I am very grateful to the Harvard University Grant Committee for three Ernst Mayr Grants that allowed me to travel and study specimens in the Museum of Comparative Zoology and other museums and institutions in the USA and Europe. I am much indebted to Prof. Dr Seiki Yamane for access to *Polyrhachis* specimens from his sizeable collection and for generously donating many important specimens to the QMBA. My special thanks go to Prof. Simon K.A. Robson (JCUT), Dr Nawee Noon-anant (PSUT) and Fuminori Ito, who provided many specimens from their private collections gathered during their collecting activities throughout South East Asia. I owe my sincere thanks to Dr Steve O. Shattuck (ANIC), Assoc. Prof. Dr Yoshiaki Hashimoto (MNHA) and Hans Peter Katzmann (UUUG) for producing the digital images used for illustrations. To Dr Brian L. Fisher (CASC), I owe my thanks for permission to reproduce images taken by the *AntWeb.org* team. To the curators and other staff of the museums and institutions listed earlier, I am grateful for loans of types and other material under their supervision. Finally, I would like to extend my gratitude to Dr Chris Burwell (QMBA) for reading and commenting on the draft manuscript.

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